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AUTHOR King, Donald W.
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ABSTRACT

The nation achieves a return on the federal government's investment in research and development in essentially two ways: first by the direct outcome of the R&D efforts, and second by further use of the information derived from these efforts. The value of information is enhanced by its use, and the value of information services and products developed for dissemination purposes is achieved by making possible further use of the information. Non-federal organizations play a significant role in disseminating scientific and technical information generated under federal funding through books, journal articles, technical reports, oral presentations, and filings for patents. The federal government controls and manages most of the processing of technical reports and secondary information processes and services through clearinghouses and information analysis centers, many of which operate in the non-federal sector under federal contracts or grants. Alternative federal and non-federal relationships should be considered from the standpoint of their effect on factors that influence the extent to which information is disseminated, including price, quality of information content, efficiency of delivery service, and awareness of its availability. (DMC)

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EFFECTS OF FEDERAL AND NON-FEDERAL RELATIONSHIPS ON THE VALUE OF INFORMATION AND INFORMATION SERVICES AND PRODUCTS

(Public Sector/Private Sector Information Problems and Solutions)

Donald W. King

King Research Inc.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
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ABSTRACT

Several studies have been performed by King Research which attempts to measure the value of information and information services and products. This paper looks at the relationships of federal and non-federal sectors in handling information generated under federal funding and how those relationships would hypothetically affect the value of information and the information services and products used to provide access to it.

There is a tendency in recent years to focus on the adversarial relationship between federal and non-federal sectors concerning information transfer processes. I would like to preface my remarks by a reminder that the beneficial relationships by far exceed the detrimental ones. Yet minor, but sometimes necessary skimishes seem to dominate our thinking and they tend to distort the overall true picture of what is happening. It is my hope in the future that we can devote more of our energies toward furtherance of those we serve in science, medicine and other fields by addressing the ennumerable issues that we have in common such as future information research and technology, economic and systemic interdependencies, transborder flow of information and so on.

Last year, King Research embarked on a study for the Department of Energy, Technical Information Center to derive a means of assessing the value of information and information services and products. Today, I would like to demonstrate how federal and non-federal and relationships might affect these values. Joe Clark mentioned that the Federal government

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expends nearly $50 billion annually on research and development. The nation achieves a return on this investment in essentially two ways; first by the direct outcome of the R&D efforts and second by how the information derived by those efforts are used in the future. Research by King Research and others have shown that scientists and engineers spend an enormous amount of time acquiring, reading and using information. The value of information is enhanced by its use and the value of information services and products is achieved by making possible the further use of information.

The value of reading and using information can be manifested in many ways such as in saving time or equipment necessary to perform research, improving research results, better education or better management. Value of information can be viewed from several perspectives such as user's willingness to pay for it or savings achieved from funders. Regardless of how value is manifested or to whom value is achieved, amount of use of information determines its value. Use of information depends on its being communicated and information services and products are developed for communication purposes.

The extent to which journals or technical reports, for example, are purchased depends on a number of factors such as price; quality of information content, graphics, format, etc.; performance such as speed of delivery and currency; and awareness of the existence of the journal articles and technical reports. Awareness can come in many ways such as advertising, word of mouth, citations, just browsing, searching bibliographic products and services, to name a few ways. Similarly, use of secondary information comes only after purchase or acquisition of secondary products and services; which in turn depends on price, performance, quality and awareness.

Lowering price, increasing quality, improving performance or increasing awareness of a product or service should increase purchases (or acquisitions). Of course, subscribing to a journal does not necessarily mean it will be read. However, over all subscribers one would expect an increased number of subscriptions will yield an increased number of readings and use of primary information. Information is used for many purposes such as education of onself and others, research and management.

Presumably each such activity will be improved through greater use and ultimately help the nation in such ways as improving productivity, balance of trade, use of energy resources, quality of life and so on.

As mentioned earlier, one of the most complex issues facing the information community involves the counterproductive polarization of positions concerning the relationship between public and private sector information organizations. This paper deals with some of the issues concerning these relationships and attempts to determine the effect various relationships have on the value of information as defined earlier. This is not to disregard other effects such as legal, administrative policical and social ones. The thrust of this approach is knowing what factors affect value and how changes in the factors are influenced by federal and non-federal relationships. A goal of this discussion is to help strike a proper balance between the federal and non-federal sectors which will achieve the optimum benefit to our nation.

The federal and non-federal relationships that seem to be of concern can be grouped into three types:

- o Relationships found in processing information generated through federal funds.
- o Relationships in operating federally-funded information organizations.
- o Relationships in funding and performing information research and development.

Each of these is discussed briefly below.

There is a long history of cooperative relationships between the federal and non-federal information sectors. For example.

- o Scientific and technical information generated under federal funds resulted (in 1977) in 100,000 books, 210,000 journal articles, 140,000 technical reports, 340,000 oral presentations, and 11,000 filings for patents. Total federal expenditures in scientific and technical information transfer amounted to $6.4 billion.

- o Non-federal oganizations play a significant role in this process. The non-federal sector received the following amounts from federal expenditures:

  - $900 million for authorship
  - $ 23 million for page charges
  - $ 82 million in subsidies to libraries
  - $ 45 million for abstracting and indexing
  - $768 million for searched services
  - $120 million for purchased library services, for a total of $1.9 billion

Currently, most scholarly journals dealing with information generated from federally funded research are published by the non-federal sector. This policy is beneficial because the published journals can bundle an average of 205 articles together in several issues to sell as a package. These articles are gathered together by subject field in a single journal from both government and non-government funded sources of information. Spreading the cost of production and distribution over a large number of articles permits a lower price, which increases quantities demanded and therefore increases value of the articles. Furthermore, non-federal publishers can bring to bear other important capbilities such as the ability to market to non-federal as well as federally-funded scientists and engineers, thereby lowering price.

One possibility is for the federal government to take actions that will help reduce the price of journals. The government currently pays page charges to non-profit societies and/or publishers which has the effect of substantially lowering the fixed costs and, therefore, the price of the journals. In fact, the average amount of page charges paid by the government is $470 per article published. For those journals that require page charges, this levy has the effect of lowering price by about $22 which means the number of subscribers might be increased as much as 30 subscribers This has the possible effect of increasing the apparent reader value by $70,000 per journal and consequential value by $350,000 per journal. The cost to the government is $65,000 per journal so the net apparent value would be about $5,000 per journal and the net consequential value would be about $285,000 per journal.

Another issue deals with sale of technical reports generated under government funded research. There are some major differences between

journal articles and technical reports. First, the average number of readings of technical reports is about 250, compared to an average number of 650 readings of journal articles. Second, the fixed cost of producing technical reports is very small compared to journals. The average number of pages of technical reports is about 10 to 25 times that of journal articles so that packaging several reports for distribution is not feasible. The biggest problem is that readings of technical reports (as well as articles) follow a highly skewed distribution which means that some items have a large number of readings but most of them have a low number of readings. This does not mean that the items with low readings are necessarily of low quality, but that they may have a low inherent audience due to the narrowness of the topic. This means that a non-federal organization (particularly profit making organizations) might "skim the cream" and sell only the frequently read technical reports.

Some examples are given here for Department of Energy information. The current policy for DOE is to distribute DOE generated technical reports free to DOE-funded scientists and engineers through standard distribution lists and on-demand. The policy of distributing technical reports free makes some sense because the invoicing and payment process costs would probably negate the benefits of marginal charging. Clearly, the free distribution has increased value of the DOE technical reports. It is estimated that 50 percent of the readings of technical reports are identified through the standard distribution. The second method of distributing DOE generated reports is through GPO and NTIS. This procedure provides a means for non-DOE funded scientists and engineers to gain access to technical reports. The idea of having a single place (NTIS) to order copies of technical reports also is beneficial. It reduces aggrevation and costs to users and, therefore, should increase value. Also the avoidance of transfer of monies within an agency is not an issue, so that a low user charge is valid. However, the value of the technical reports (thereby return on investment in research and development) will be optimized by charging only to recover marginal costs. This is what is currently being done.

If the collection were turned over to a non-federal organization without restrictions on "skimming the cream" or on pricing, some value of the technical reports might be lost. For example, if the paper copies of technical reports were priced to optimize profit there would be a substantial loss in value. It can be shown that a very large profit could be made by selling the technical reports at $14.40 on the average, but hypothetically a total of $1.3 million would be lost in terms of apparent value in reading and $47 million would be lost in terms of consequential value in savings.

As indicated above, there is a long and favorable history of federal and non-federal sector relationships in processing information generated under federal funds. In one instance, publishing journals, the federal government exercises little control or management of the information even though a substantial amount is expended by the federal government in information transfer through the journal medium. On the other hand, the federal government controls and manages most of the processing of technical reports and secondary information products and services. They do this primarily through operations of information organizations such as clearinghouses, information analysis centers and the like. However, it is found that, even though the federal government funds such information organizations, and controls them to a degree, the non-federal sector is generally heavily involved either by operating the organization or through performing a number of functions when the organization is operated in-house. It is clear that any such relationship should be established to increase value through:

(1) Decreasing costs of operations by using better technology, lowering labor rates, increasing productivity through better management, etc.

(2) Increasing quality by screening input better, improving printing quality, etc.

(3) Improving performance such as faster turnaround time.

(4) Marketing more extensively through existing channels or by better methods.

This is not to say that current federally-operated information organizations are inadequate in the areas of cost, quality, performance or awareness. It merely means that in deciding on arrangements with the non-federal sector based on their effect on value, the above factors should be considered for decisions.

There are special arrangements that might be made. For example, it might make sense to let or help the non-federal sector distribute technical reports in addition to NTIS, or to let them sell the paper copies. If they processed the bulk of the high selling technical reports, or sold all the paper copies, NTIS would avoid the large storage costs and could serve as a microform distributor and archive. In this way, the advantages of both the federal and non-federal organizations could be taken advantage of in order to maximize value.

The non-federal sector presently plays an important role in operating federally-funded information organizations. For example, out of 196 federally-funded information organizations, 79 were operated (in 1979/80) under contract or grant for a total budget of about $33 million. In addition, the non-federal sector received about $61 million in contracts for products, supplies, services, etc., from federal in-house operations. The Department of Energy operates most of its information organizations out-of-house under contract or grant. An exception is the Technical Information Center (TIC) which operates in-house. Even so, the non-federal sector benefits greatly from the TIC-operated operation. TIC derives its $17.3 million income from $13.5 million direct appropriations, $1 million from other DOE-funded programs, $500 thousand from NTIS reimbursables and $2.3 million from national laboratories for services such as printing.

TIC disperses much of its funds ($6.5 million) to commercial firms as follows:

- $1.2 million for contracts on software, design and other services
- $1.2 million for abstracts and database tapes
- $170 thousand for microfiche services
- $300 thousand for marketing and travel
- $2.2 million for communications, supplies and other such items, and
- $1.3 million for printing and supplies.

TIC also expends about $4.3 million on products and services provided by national laboratories and universities.

Since price is an important factor related to value and since it is also one of the principal areas of contention between the federal and non-federal sectors, it is discussed separately here. Price here means the monies given in exchange for copies or use of information products and services. Economic theory indicates that in nearly all situations, the quantities demanded for information products and services vary inversely with changes in price where an increase in price yields a decrease in quantities demanded. Employing the philosophy that value to readers can be determined in part by willingness to pay for information products and services as measured by the area under the price demand curve, one can see that decreases in price yield increases in quantity demanded which in turn increases value. The degree to which this happens depends on how sensitive quantities demanded are to price changes which is determined in part by the inherent need for or potential use of the information content, attributes of substitute means of searching or acquiring the information, and other attributes of the information product or service. Also, value can be assessed by dollar savings achieved from reading.

Rough estimates of value lost by increasing prices are given as follows:

Product or Service	Change in Price	Loss in Value to Readers	Loss in Value in Terms of Savings
Journals	$1.00 increase per subscription	$27,000	$410,000
Technical Reports (NTIS)	$1.00 increase per copy	$230,000	$8.0 million
RECON Searches	$1.00 increase per search	$3.4 million	$84 million

Thus, it is clear that alternative federal and non-federal relationships should be considered from the standpoint of their effect and price since price changes have such as important affect on value.

The federal government has funded research and development in information related fields over the years through the National Science Foundation, the National Library of Medicine, the Department of Education, the Department of Defense and other agencies. The extent of R&D funding has diminished dramatically in recent years, although there is no good estimate as to how much funding has been or currently is involved. What is known is that many developments in online bibliographic systems, library technology, linguistics, artificial intelligence and other areas were funded by the federal government. NASA's RECON and NLM's MEDLINE were the first large-scale operational online bibliographic retrieval systems and were the genesis of the largest commercial online vendors. Williams has pointed out that the Lister Hill Center of NLM has also recently conducted research on the application of videodisc technology which has been adapted by several firms through technology transfer. National Library of Medicine research also led to development of a minicomputer-based library automation system which is now being provided by two private firms. It seems clear that a great deal of the advancement in information technology is due to federal funding and the private sector has benefited from its.

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